

WHAT IS CLAIMED IS:

1. A spraying system for spraying scale conditioning liquid on opposite sides of a moving strip of metal comprising:

a housing defining a chamber through which the moving strip passes on a strip pass line;

at least one nozzle maintenance station disposed off of the strip pass line;

a first set of spray nozzles having a first array of nozzles mounted on a first nozzle mounting structure, a second array of nozzles mounted on a second nozzle mounting structure, and an actuation mechanism to move said first set of nozzles between

(a) a first position wherein said first array of nozzles is disposed on one side of said strip pass line, and said second array of nozzles is disposed on the opposite side of said strip pass line; and

(b) a second position wherein said first and second arrays of said nozzles are disposed at a nozzle maintenance station;

a second set of spray nozzles having a third array of nozzles mounted on a third nozzle mounting structure, and a fourth array of nozzles mounted on a fourth nozzle mounting structure, and an actuating mechanism to move said second set of nozzles between

(c) a first position wherein said third array of nozzles is disposed on said one side of said strip pass line and spaced from said first array of nozzles, and said fourth array of nozzles is disposed on said opposite side of said strip pass line spaced from said second array of nozzles, and

(d) a second position wherein said third and fourth array of nozzles are disposed at a nozzle maintenance station.

2. The invention as defined in claim 1 wherein each nozzle maintenance station includes facilities for spraying liquid on said nozzles disposed in said nozzle maintenance station.

3. The invention as defined in claim 2 wherein each nozzle maintenance station includes facilities for drying a portion of said nozzles disposed in said nozzle maintenance station.

4. The invention as defined in claim 1 wherein each nozzle of each said array of nozzles is independently replaceable.

5. The invention as defined in claim 1 wherein said sprayed liquid from each nozzle has an asymmetric spray pattern with a major and minor axis..

6. The invention as defined in claim 5 wherein the nozzles in each array define a line that is essentially transverse to the strip pass line when in said first position, and the major axis of the spray pattern of said sprayed liquid is at an acute angle with respect to a line lying on the strip pass line and transverse to the direction of travel of the strip.

7. The invention as defined in claim 1 wherein each of said first and second nozzle mounting structures is pivotally mounted for moving to said first and second positions.

5 8. The invention as defined in claim 1 wherein each of said first and second nozzle mounting structures is retractably mounted for moving to said first and second position.

10 9. The invention as defined in claim 1 wherein each of said first and second nozzle mounting structures is reciprocally mounted for moving to said first and second positions.

15 10. The invention as defined in claim 1 characterized by a sensing device control structure associated with each nozzle to actuate nozzle cleaning action upon sensing of a given condition.

11. The invention as defined in claim 10 wherein said sensing device associated with each nozzle senses diminished or lack of liquid spray.

20 12. The invention as defined in claim 1 further characterized by a control device operationally connected to each of said nozzles to selectively purge the nozzle with a cleaning liquid.

13, The invention as defined in claim 1 wherein the actuating mechanism is configured to move each of said arrays of nozzles between said first and second positions independently of each other array.

5 14. The invention as defined in claim 1 wherein said actuating mechanism to move the first and second arrays of nozzles is connected to move both arrays together, and said actuating mechanism to move said third and fourth arrays of nozzles is connected to move both third and fourth arrays together.

10 15. A method of spraying scale conditioning liquid on opposite sides of a moving strip of metal comprising the steps of:

providing a housing defining a chamber through which the moving strip passes on a strip pass line;

providing at least one nozzle maintenance station disposed off of the strip pass line;

15 providing a first set of spray nozzles having a first array of nozzles mounted on a first nozzle mounting structure, and a second array of nozzles mounted on a second nozzle mounting structure, and an actuating mechanism to move said first set of nozzles between

(a) a first position wherein said first array of nozzles is disposed on one side of said strip pass line, and said second array of nozzles is disposed on the opposite side of said strip pass line; and

20 (b) a second position wherein said first and second arrays of said nozzles are disposed in a nozzle maintenance station;

a second set of spray nozzles having a third array of nozzles on a third nozzle mounting structure, and a fourth array of nozzles mounted on a fourth nozzle mounting structure, and an actuating mechanism to move said second set of nozzles between

(c) a first position wherein said third array of nozzles is disposed on said

5 one side of said strip pass line and spaced from said first array of nozzles, and said fourth array of nozzles is disposed on said opposite side of said strip pass line spaced from said second array of nozzles, and

(d) a second position wherein said third and fourth array of nozzles are disposed at a maintenance station;

10 normally maintaining at least one set of spray nozzles in said first position; and periodically moving each array of spray nozzles to said second position while the nozzle arrays in the other set are positioned in the first position.

16. The invention as defined in claim 15 wherein each nozzle maintenance station includes facilities for spraying liquid on said nozzles disposed in said nozzle maintenance station, and said nozzles are sprayed with said cleaning liquid in said maintenance station.

17. The invention as defined in claim 16 wherein each nozzle maintenance station includes facilities for drying at least some of said nozzles disposed in said nozzle maintenance station.

18. The invention as defined in claim 15 wherein the nozzles of each array of nozzles are independently replaceable.

19. The invention as defined in claim 15 wherein said sprayed liquid from each nozzle has an asymmetric spray pattern with a major and minor axis.

20. The invention as defined in claim 19 wherein the nozzles in each array define a line that is essentially transverse to the strip pass line when in said first position, and the major axis of the spray pattern of said sprayed liquid is at an acute angle with respect to a line lying on the strip pass line and transverse to the direction of travel of the strip.

21. The invention as defined in claim 15 wherein each of said first and second nozzle mounting structures is pivotally mounted for moving to said first and second positions.

22. The invention as defined in claim 15 wherein each of said first and second nozzle mounting structures is retractably mounted for moving to said first and second positions.

23. The invention as defined in claim 15 wherein each of said first and second nozzle mounting structures is reciprocally mounted for moving to said first and second positions.

24. The invention as defined in claim 15 characterized by a sensing device and control structure associated with each nozzle to actuate nozzle cleaning action upon sensing of a given condition.

5 25. The invention as defined in claim 15 further characterized by selectively purging each nozzle with a cleaning liquid responsive to a sensed condition thereof.

26. The invention as defined in claim 15 wherein each of said arrays is moved between its first and second positions independently of each other array.

10 27. The invention as defined in claim 15 wherein said first and second arrays of nozzles constituting the first set of spray nozzles are movable together, and said third and fourth arrays of nozzles constituting the second set of spray nozzles are movable together.

15 28. Apparatus for providing uninterrupted delivery of descaling liquid to a continuously passing metal strip, comprising:

a first array of nozzles normally positioned to spray the full width of said passing metal strip and movably mounted for repositioning to a maintenance station remote from said passing metal strip; and

20 a second array of nozzles normally positioned in a maintenance station remote from said passing metal strip and movably mounted for repositioning to spray the full width of said passing metal strip.